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R E M A R K S

The Office Action issued December 26, 2001 has been received and its contents have been carefully considered.

The indication by the Examiner that claims 3 and 6-12 contain allowable subject matter is noted with appreciation.

Submitted herewith is a copy of Fig. 1 of the drawings with a proposed correction indicated in red. The word "valve" in element 6 is a typographical error and should be changed to -- value --. Support for this change may be found on page 9, line 4 of the specification. The Examiner's approval of this minor correction is respectfully requested.

Independent claims 1 and 11 have been amended to recite, in their preambles:

"a diode selected from the group consisting of a light emitting diode and a laser diode".

Consequently, wherever the word "diode" later appears, either in claims 1 and 11 or in claims which are dependent therefrom, it is clear that such a diode is either a light emitting diode or a laser diode.

Claim 1, which is in Jepson form, and thus incorporates the preamble recited step of "stabilizing the optical output power...", has been amended to include the step of:

"deriving a measure for the light power emitted by the diode from a combination of the forward current and the forward voltage of the diode, based on the assumption that..."

It is believed that the claim rejections under 35 USC §112 have been overcome by these amendments.

The Invention of Claim 1:

The method according to the present invention for stabilizing the optical output power of the light emitting diodes and laser diodes may be stated as: "Thou shalt derive a measure for the light power which is emitted by the diode from the combination of its forward voltage and forward current."

A principal point of the invention is that the temperature of many diodes can also be derived from the combination of forward voltage and forward current. Persons skilled in the art previously thought that they must know the temperature in order to compensate its influence on the emitted light power. Consequently, great efforts have been

made to measure that temperature, even though such temperature may be obtained from the diode itself.

Furthermore, if the optical output power depends from forward current and temperature, and the temperature can be derived from forward current and forward voltage, then the optical output power can also be derived from the forward current and forward voltage, and knowing this is sufficient for stabilizing the optical output power. There is no need in this case to even know that there is an additional quantity named "temperature" involved. Such is the "improvement" recited in the method claim 1.

#### Claim Rejections Under 35 USC §102

Asano et al. disclose a method for stabilizing a laser diode by measuring the ambient temperature and compensating its effect on the optical output power by adjusting the diode forward voltage to a value which indicates the desired output power at the measured ambient temperature. The diode voltage is adjusted by adjusting the diode current, which is not taken into account. The temperature measuring devices used for this purpose are a temperature detecting portion (74) in Fig. 7, a thermistor (81) in Fig. 8, and a positive characteristic thermistor (121) in Fig. 12. They are

mentioned in Col. 8, lines 9, 19-20, 25 and 53, Col. 10, lines 39-40 and 47 and Col. 11, lines 12-13. In Col. 10, lines 35-40 it is said that the ambient temperature is measured by the temperature detecting portion (74) so it can be deduced that also the thermistor (81) and the positive characteristic thermistor (121) are exposed to the ambient temperature.

In contrast, applicants disclose a method to stabilize LED or laser diodes by taking only the diode forward voltage and current into account, ignoring temperature completely. None of the stabilizing circuits given in Figs. 3 and 10-15 incorporate any temperature-sensitive device except for the LED or laser diode itself. Nevertheless, the influence of temperature on the optical output power is compensated. Furthermore the temperature, the effect of which is compensated, is the temperature of the LED or laser diode itself. This is the temperature which is responsible for changes of the optical output power. The ambient temperature is not a definite measure for such changes.

Both the methods of Asano et al. and applicants have in common that, before the LED or laser diode can be put into operation, there must be some step of characterizing its behavior: With both methods, the device must be exposed to

different temperatures, while its optical output power is kept constant. To do so, both methods require measurement of the optical output power at that point. They differ in that Asano et al. record the relation between temperature and diode forward voltage while applicants record the relation between diode forward voltage and diode current.

By this, Asano et al. replace the need to know the optical output power during operation of the diode, in order to keep it constant, with the need to know the ambient temperature which is much easier to measure because it is not modulated as the optical output power is. Applicants eliminate the need to know either of these non-electrical quantities.

The description of the method disclosed by Asano et al. is presented here to explain that the rejection of claims 1, 2, 4 and 5 is not wrong; however, it is not complete enough to point out what applicants have achieved with their method. First, the laser system of Asano et al. does not control the current of the laser diode by detecting the voltage of the laser diode; it controls the current while also detecting the voltage. Both are sub-tasks of what the laser system really does; it adjusts the voltage of the laser diode to some nominal value by detecting its actual

value, then by computing ("detecting") its deviation from the nominal value and controlling the current in a way that this deviation becomes zero.

Second, the laser system of Asano et al. makes adjustments to the current according to the deviation of the laser diode voltage from some nominal value which is obtained by reproducing variations of the laser diode voltage which were recorded during a past measurement and caused by temperature changes, while maintaining a constant output light by measuring it and adjusting it to a constant value. Understanding the given description as -- "The laser system makes adjustments to the current when the laser diode voltage varies due to temperature changes, thus maintaining a constant output light." -- would be completely wrong. The adjustments to the current happen at one occasion, and the variations of the laser diode voltage along with the temperature changes and the maintaining of a constant output light happen at another.

However, with the above accomplishments, the explanation of the method given by Asano et al. is still incomplete because it does not point out how the laser system knows for what temperature to reproduce the correct nominal value. It knows it because it is able to measure

the ambient temperature which the nominal value is then reproduced for.

The method according to the present invention can be implemented in a way which allows a description very similar to the one above. It allows control of either the current by adjusting the voltage or vice versa, but if the voltage is controlled by adjusting the current, the sentence quoted above becomes true as well. In this case, however, the sentence will have to be changed to read: "The laser system makes adjustments to the current according to the deviation of the laser diode voltage from some nominal value which is obtained by deriving it from the current itself using a relation between voltage and current which was derived from variations of voltage and current which were recorded during a past measurement and caused by temperature changes, while maintaining a constant output light by measuring it and adjusting it to a constant value".

This explanation does not leave any question unanswered because temperature is not involved when it comes to obtaining the nominal value. However, for better understanding one might add: "As the current changes, the nominal value for the voltage also changes until the voltage equals its nominal value and no further adjustment is made."

(It is not clear that the nominal value changes in a way that the voltage can ever reach it but it does, and the system is stable). This is not true with a method according to Asano et al. because in this case the nominal value is constant for a given ambient temperature.

Even if the method according to the present invention is implemented in a similar manner to that by Asano et al. (as is possible), the underlined parts in the above description must be different from the respective description of the method by Asano et al. Although these are only a few words, they refer to major, very basic differences. These differences lead to the elimination of all "physics" (i.e., quantities not mentioned in Ohm's law) from the task of operating an LED or laser diode with constant optical output power, leaving a simple electrical problem.

Therefore, the method recited in claim 1, is not anticipated by Asano et al. The method given by Asano et al. does not eliminate the need to take temperature into account, while the method of the present invention does. This is not achieved by modification or extension of a method like that of Asano et al., but by a completely different approach which leads to various possibilities of



implementation. Only one of these possibilities is an embodiment which looks similar to the embodiment that a method according to Asano et al. is restricted to.

The Table on the next page is provided to enable the Examiner to visualize the basic differences between the two methods. There are common steps and different steps which, with a method according to the present invention, can be, but need not be, carried out as with a method according to Asano et al. The fields of these steps are extended into the right half of the Table leaving space for the alternative way.

# Stabilising the Optical Output Power of Light Emitting Diodes and Laser Diodes According to

Asano et al.

Plamper et al.

I. Characterisation of LED / Laser Diode	a. Establish Conditions	1.	Adjust optical output power of LED / laser diode to desired constant value	
		2.	Vary ambient temperature	Vary either ambient temperature or directly temperature of LED / laser diode
	b. Measure Behaviour	1.	Measure forward voltage	
		2.	Measure ambient temperature	Measure current through LED / laser diode
		3.	Record forward voltage <u>as a function of ambient temperature</u>	Record forward voltage <u>as a function of current</u> or vice versa
II. Operation of LED / Laser Diode	a. Establish Conditions	1.	Supply LED / laser diode with adjustable current source	Supply LED / laser diode with adjustable voltage source
		2.	Measure forward voltage	Measure current through LED / laser diode
	b. Consider Temperature	1.	Measure ambient temperature	No need to worry about temperature
		2.	Obtain forward voltage corresponding to ambient temperature obtained at II.b.1 when functional correlation obtained at I.b.3 is obeyed	
	c. Compensate Temperature Effect	1.	Adjust	
			forward voltage	current through LED / laser diode
		2.	to the value obtained at II.b.2 by varying	to the situation (there is only one) where the combination of current and forward voltage obeys the functional correlation obtained at I.b.3 by varying
		3.	current through LED / laser diode	forward voltage

The high level of abstraction necessary to make both methods comparable in this Table causes them to look more similar than they are. For example, during operation there is hardly ever a real measurement done:

Asano et al. do not measure temperature but generate a reference voltage using temperature-dependent components and the voltage at the diode is also not measured but only compared to that reference voltage.

In one embodiment of the present invention, diode voltage and current are truly measured but with another embodiment everything is done by operating the diode with a well-defined supply voltage and series resistor. These different possibilities are far from being similar and this results from the basic differences shown in this Table.

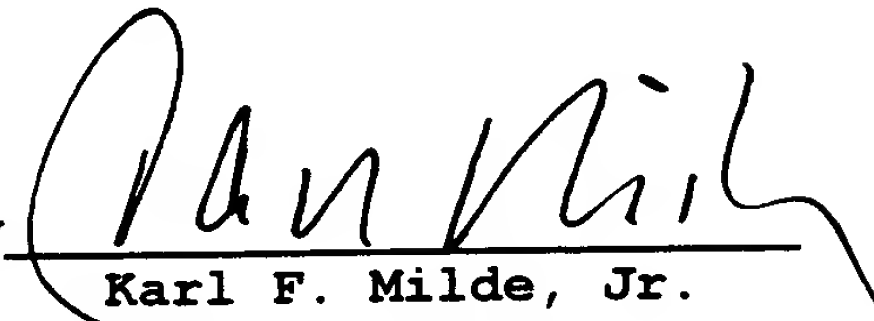
Claims 2, 4 and 5 have also been rejected as being anticipated by Asano et al. Claim 4 recites the method step of considering the function which yields the voltage (which is necessary to obtain constant light) from the current to be linear. The slope of this function can be positive, negative or zero. Claims 5-7 refer to these three cases. Although claims 6 and 7, referring to a negative and a positive slope, have been indicated as being allowable, claim 5 referring to a zero slope has been rejected. Thus, two of three special cases have been rejected while the third one and the general case (recited in claim 4 which is common to all three) are not.

Accordingly, it is believed that independent claim 1, as well as dependent claims 2, 4 and 5, distinguish patentably over Asano et al.

Since the formal issues raised by the Examiner have been overcome by this Amendment, and since all of the claims are believed to distinguish patentably over the single cited reference to Asano et al., this application is believed to

be in condition for immediate allowance. A formal Notice of Allowance is accordingly respectfully solicited.

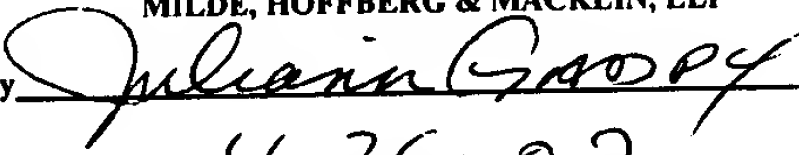
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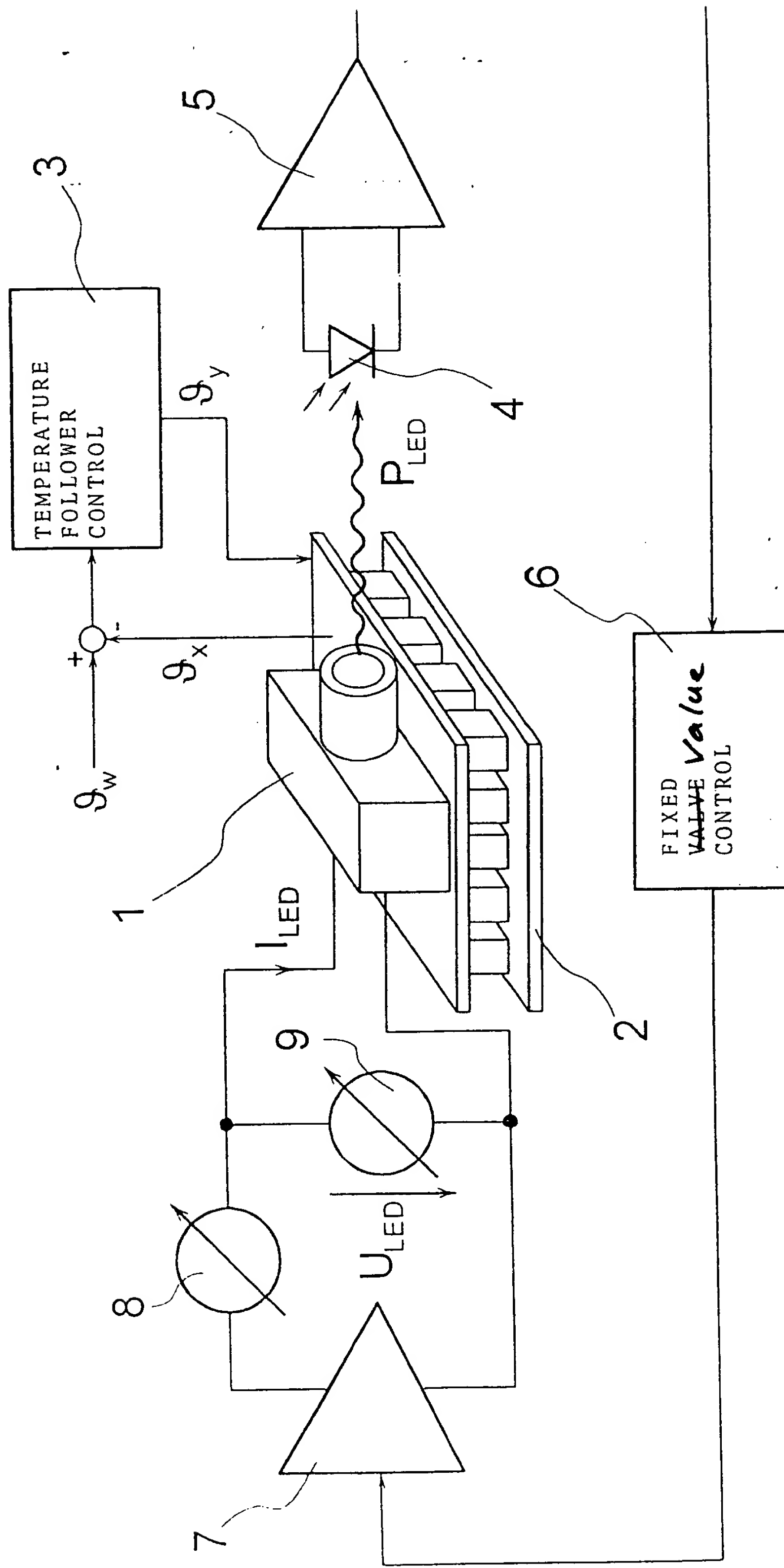


Fig. 1



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IN THE CLAIMS:

Please amend claims 1, 5 and 11 to read as follows:

1. (Twice Amended) In a method for stabilizing the optical output power (light power) of a diode selected from the group consisting of a light emitting [diodes] diode and a laser [diodes] diode, the improvement [wherein the] comprising the step of deriving a measure for the light power emitted by the diode from a combination of the forward [diode] current and forward voltage of the diode, [serves as a definite measure for the light power emitted by the diode, where it is assumed] based on the assumption that at a constant light power the forward voltage is a function of the [diode] forward current.

5. (Twice Amended) The method as set forth in claim 4, wherein in the case of a constant forward voltage at a constant light power and an increasing diode current this correlation is established [through the operation of the diode using] by directly connecting the diode to a constant voltage source.

11. (Twice Amended) A method for determining the forward voltage of a diode, selected from the group consisting of a light emitting diode [or] and a laser diode, as a function of the diode current at a constant light power, comprising the steps of: varying the temperature of the diode using a heating or cooling device; determining the emitted light power by means of a photodetector; and maintaining the emitted light power at a constant level by means of a control device and wherein the values of the forward voltage and the diode current are measured at various temperatures.